Charotar University of Science and Technology (CHARUSAT)

Devang Patel Institute of Advance Technology and Research (DEPSTAR)

Department of Computer Science and Engineering

Lesson Planning Document (LPD)

1. GENERAL DETAILS

Faculty Name:	Ankita Amaravat	Faculty Email:	ankitaamaravat.cse@charusat.ac.in	Department:	Computer Science and Engineering (CSE)
Subject Code:	OCCSE4002	Subject Name:	SOCIAL NETWORK ANALYSIS	Term Duration:	23-06-2025 to 10-10-2025
Semester:	7th semester	Division:	Division 1 & Division 2	Academic Year:	2025-26
Lecture Hours/week:	3	Lab Hours/week:	2	Credits:	4
Course Prerequisites:	Python programming, Probability and Statistics, Machine Learning				
Course Prerequisites Materials:	Python: The Complete Reference by Martin C. Brown , Machine Learning, Tom Mitchell, McGraw Hill, 1997.				

2. UNIT DETAILS

Unit 1

Unit Name:	Foundations of Social Network Analysis	Faculty Name:	Ankita Amaravat
Start Date:	23/06/2025	End Date:	04/07/2025
No. of Lectures:	6	CO Mapping:	CO1
Unit Topics:	Introduction to SNA Introduction to Python/Colab, Introduction to NetworkX – Part I Network Measures Introduction to NetworkX – Part II		
Self Study Topics:	N/A		
Self Study Materials:	N/A		
Teaching Pedagogy:	ICT based learning, Chalk and Talk, Active Learning		
Skill Mapping:	Technical Skills, Cognitive Skills		
Unit Materials:	Social Network Analysis, Tanmoy Chakraborty, Wiley, 2021 Network Science, Albert-Lazzlo Barabasi Social Network Analysis: Methods and Applications, Stanley Wasserman, Katherine Faus		
Skill Objectives:	API data extraction NoSQL database handling Network modelling and visualization Data pre-processing		
Topics Beyond Unit:	Temporal/Time-Evolving Networks		
Interlink Topics:	N/A		

Unit 2

Unit Name:	Structural Patterns and Dynamics of Networks	Faculty Name:	Ankita Amaravat
Start Date:	07/07/2025	End Date:	17/07/2025
No. of Lectures:	7	CO Mapping:	CO2, CO3
Unit Topics:	Random graph model Preferential attachment Small-world model Real-world implications and model comparisonsPageRank and its variations HITS (Hyperlink-Induced Topic Search) Random walks and Markov chains on graphs Applications in search engines and recommendation systems		
Self Study Topics:	N/A		
Self Study Materials:	N/A		
Teaching Pedagogy:	Chalk and Talk, ICT based learning		
Skill Mapping:	Cognitive Skills, Technical Skills, Professional Skills		
Unit Materials:	Social Network Analysis, Tanmoy Chakraborty, Wiley, 2021 Network Science, Albert-Lazzlo Barabasi Social Network Analysis: Methods and Applications, Stanley Wasserman, Katherine Faus		
Skill Objectives:	To understand and simulate the behavior of networks formed by random connections, and to analyze the threshold phenomena such as connectivity and emergence of the giant component.To model real-world networks with power-law degree distributions and to explain the emergence of hubs and scale-free properties in growing networks.o generate and analyze networks that combine high clustering with short average path lengths, mimicking real-world small-world phenomena.To critically evaluate different network generation models by comparing structural properties and to map them to real-world systems (e.g., internet, social, biological).		
Topics Beyond Unit:	Graph Neural Networks (GNNs)		
Interlink Topics:	N/A		

Unit 3

Unit Name:	Community and Connectivity Analysis	Faculty Name:	Ankita Amaravat
Start Date:	18/07/2025	End Date:	01/08/2025
No. of Lectures:	7	CO Mapping:	CO4, CO3
Unit Topics:	What are communities in a network? Evaluation metrics: Modularity, Conductance Graph partitioning vs community detectionCommunity detection algorithms: Girvan–Newman Louvain Method Label Propagation Overlapping vs non-overlapping communities Applications in social networks and biology		
Self Study Topics:	N/A		
Self Study Materials:	N/A		
Teaching Pedagogy:	Chalk and Talk, ICT based learning, Role Play, Flipped Classroom		
Skill Mapping:	Technical Skills, Cognitive Skills, Professional Skills, Leadership and Teamwork Skills		
Unit Materials:	Social Network Analysis, Tanmoy Chakraborty, Wiley, 2021 Network Science, Albert-Lazzlo Barabasi Social Network Analysis: Methods and Applications, Stanley Wasserman, Katherine Faus		
Skill Objectives:	To understand the concept of communities as tightly connected subgraphs and recognize their significance in interpreting complex network structures.To learn how to compute and interpret modularity as a measure of the quality of a network partition, and to use it in optimizing community detection.To differentiate between graph partitioning (strict divisions) and community detection (structural cohesiveness), and understand when to apply each.To detect functionally meaningful communities such as protein complexes or co-expressed genes in biological networks using graph-based methods.		
Topics Beyond Unit:	Privacy & Ethics in SNA		
Interlink Topics:	N/A		

Unit 4

Unit Name:	Predictive and Behavioral Network Models	Faculty Name:	Ankita Amaravat
Start Date:	04/08/2025	End Date:	25/08/2025
No. of Lectures:	10	CO Mapping:	CO4, CO5
Unit Topics:	Link Prediction Cascade Behavior and Network Effects Anomaly Detection		
Self Study Topics:	N/A		
Self Study Materials:	N/A		
Teaching Pedagogy:	Chalk and Talk, ICT based learning, Flipped Classroom		
Skill Mapping:	Technical Skills, Cognitive Skills, Research and Innovation Skills		
Unit Materials:	Social Network Analysis, Tanmoy Chakraborty, Wiley, 2021 Network Science, Albert-Lazzlo Barabasi Social Network Analysis: Methods and Applications, Stanley Wasserman, Katherine Faus		
Skill Objectives:	Graph theory, probability, statistics, linear algebra Algorithmic Understanding Data Science Integration: Feature engineering, model evaluation (AUC, precision-recall), time-series analysis		
Topics Beyond Unit:	Influence Maximization & Viral Marketing		
Interlink Topics:	N/A		

Unit 5

Unit Name:	Advanced Learning Techniques and Applications	Faculty Name:	Ankita Amaravat
Start Date:	26/08/2025	End Date:	19/09/2025
No. of Lectures:	11	CO Mapping:	CO5
Unit Topics:	Introduction to Deep Learning Graph Representation Learning – Part I Graph Representation Learning – Part II Coding on Graph Representation LearningApplications and Case Studies Conclusion		
Self Study Topics:	N/A		
Self Study Materials:	N/A		
Teaching Pedagogy:	Chalk and Talk, ICT based learning, Problem-Based Learning, Flipped Classroom		
Skill Mapping:	Technical Skills, Cognitive Skills, Leadership and Teamwork Skills		
Unit Materials:	Social Network Analysis, Tanmoy Chakraborty, Wiley, 2021 Network Science, Albert-Lazzlo Barabasi Social Network Analysis: Methods and Applications, Stanley Wasserman, Katherine Faus		
Skill Objectives:	To gain hands-on experience in implementing GNNs on benchmark datasets, and to fine-tune hyperparameters and visualize results. Applications and Case Studies To explore real-world GRL use cases and adapt graph learning techniques to application-specific constraints and goals. Conclusion To consolidate understanding of graph learning concepts, compare algorithms critically, and demonstrate readiness to tackle research or industrial problems involving graph data.		
Topics Beyond Unit:	Influence Maximization & Viral Marketing		
Interlink Topics:	N/A		

3. PRACTICAL DETAILS

Practical 1

Faculty Name:	Ankita Amaravat	Lab Hours:	4
Probable Week:	Week 2 (30-06-2025 - 06-07-2025)	CO Mapping:	CO1
Practical Aim:	Extract and build large real-world social networks from public Twitter APIs.		
Practical Tasks:	Build a directed weighted graph using hashtags or mentions. Store and pre-process data using a NoSQL database (e.g., MongoDB). Visualize stats like in-degree, out-degree, and density. Graph should contain at least 1000 nodes.		
Practical Pedagogy:	Project-Based Learning		
Evaluation Methods:	Viva, Lab Performance, File Submission, Code Review		
Associated Units:	Foundations of Social Network Analysis		
Blooms Taxonomy:	Apply, Analyze, Create		
Skill Mapping:	Technical Skills, Cognitive Skills		
Skill Objectives:	Data extraction, NoSQL handling, network construction, basic graph stats visualization		
Reference Material:	NPTEL Course: Social Networks by Prof. Tanmoy Chakraborty SNAP Library Documentation: https://snap.stanford.edu NetworkX, igraph Documentation		
Software/Hardware Requirements:	Python, Tweepy, NetworkX, MongoDB		

Practical 2

Faculty Name:	Ankita Amaravat	Lab Hours:	2
Probable Week:	Week 4 (14-07-2025 - 20-07-2025)	CO Mapping:	CO1
Practical Aim:	Extract tweets and construct user interaction networks (mentions or retweets).		
Practical Tasks:	Authenticate API, fetch tweets, build graph		
Practical Pedagogy:	Problem-Based/Case Study Learning		
Evaluation Methods:	Viva, Lab Performance, File Submission		
Associated Units:	Foundations of Social Network Analysis		
Blooms Taxonomy:	Analyze, Evaluate, Apply		
Skill Mapping:	Technical Skills, Professional Skills		
Skill Objectives:	Authenticate API, fetch tweets, build graph		
Reference Material:	NPTEL Course: Social Networks by Prof. Tanmoy Chakraborty SNAP Library Documentation: https://snap.stanford.edu NetworkX, igraph Documentation		
Software/Hardware Requirements:	Python, NetworkX		

Practical 3

Faculty Name:	Ankita Amaravat
Lab Hours:	4
Probable Week:	Week 4 (14-07-2025 - 20-07-2025)
CO Mapping:	CO2
Practical Aim:	Multi-Centrality Analysis on Large Networks. Implement and compare centrality metrics on scale-free and random networks.
Practical Tasks:	Apply multiple centrality algorithms: PageRank, Katz, Eigenvector, Closeness, and Betweeness. Use libraries such as NetworkX, SNAP, 2and igraph. Compare time complexities and analyze scalability. Generate a tabular comparison and line plot of centrality distributions.
Practical Pedagogy:	Problem-Based/Case Study Learning
Evaluation Methods:	Viva, Lab Performance, File Submission
Associated Units:	Community and Connectivity Analysis, Structural Patterns and Dynamics of Networks
Blooms Taxonomy:	Analyze, Evaluate, Create
Skill Mapping:	Technical Skills, Cognitive Skills, Professional Skills
Skill Objectives:	Implement multiple centrality algorithms and compare on different graph types
Reference Material:	NPTEL Course: Social Networks by Prof. Tanmoy Chakraborty SNAP Library Documentation: https://snap.stanford.edu NetworkX, igraph Documentation
Software/Hardware Requirements:	Python, NetworkX

Practical 4

Faculty Name:	Ankita Amaravat	Lab Hours:	2
Probable Week:	Week 6 (28-07-2025 - 03-08-2025)	CO Mapping:	CO3
Practical Aim:	Implement SIR and SIS diffusion models on real-world graphs.		
Practical Tasks:	Simulate spread and analyze outcomes. Run diffusion models, visualize spread progression, analyze role of high-degree nodes.		
Practical Pedagogy:	Experiential Learning		
Evaluation Methods:	Viva, Lab Performance, File Submission		
Associated Units:	Community and Connectivity Analysis		
Blooms Taxonomy:	Apply, Evaluate, Analyze		
Skill Mapping:	Technical Skills, Cognitive Skills, Professional Skills		
Skill Objectives:	Simulate SIR/SIS models, visualize diffusion, analyze influence of high-degree nodes		
Reference Material:	NPTEL Course: Social Networks by Prof. Tanmoy Chakraborty SNAP Library Documentation: https://snap.stanford.edu NetworkX, igraph Documentation		
Software/Hardware Requirements:	Python, NetworkX		

Practical 5

Faculty Name:	Ankita Amaravat	Lab Hours:	2
Probable Week:	Week 7 (04-08-2025 - 10-08-2025)	CO Mapping:	CO3
Practical Aim:	Create bipartite graphs from affiliation data (e.g., users–movies). Project onto one-mode graphs and analyze.		
Practical Tasks:	Build bipartite graph, project, calculate metrics		
Practical Pedagogy:	Problem-Based/Case Study Learning		
Evaluation Methods:	Viva, Lab Performance, File Submission		
Associated Units:	Community and Connectivity Analysis		
Blooms Taxonomy:	Analyze, Evaluate, Create		
Skill Mapping:	Technical Skills, Cognitive Skills, Professional Skills		
Skill Objectives:	Build bipartite graph, project, calculate metrics		
Reference Material:	NPTEL Course: Social Networks by Prof. Tanmoy Chakraborty SNAP Library Documentation: https://snap.stanford.edu NetworkX, igraph Documentation		
Software/Hardware Requirements:	Python, NetworkX, igraph		

Practical 6

Faculty Name:	Ankita Amaravat	Lab Hours:	4
Probable Week:	Week 8 (11-08-2025 - 17-08-2025)	CO Mapping:	CO3
Practical Aim:	Problem Definition: Generate scale-free and random graphs. Apply centrality algorithms: Degree, Betweenness, Closeness, Eigenvector, PageRank. Compare performance across graph types.		
Practical Tasks:	Generate graphs, apply centrality metrics, compare results, visualize using plots.		
Practical Pedagogy:	Problem-Based/Case Study Learning		
Evaluation Methods:	Viva, Lab Performance, File Submission		
Associated Units:	Community and Connectivity Analysis		
Blooms Taxonomy:	Apply, Analyze		
Skill Mapping:	Technical Skills, Professional Skills		
Skill Objectives:	Understand the structural differences between scale-free and random graphs Evaluate the computational performance and complexity of each centrality algorithm across different graph types. Analyze scalability and suitability of centrality measures based on network type and size.		
Reference Material:	NPTEL Course: Social Networks by Prof. Tanmoy Chakraborty SNAP Library Documentation: https://snap.stanford.edu NetworkX, igraph Documentation		
Software/Hardware Requirements:	Python, NetworkX, igraph, SNAP		

Practical 7

Faculty Name:	Ankita Amaravat	Lab Hours:	4
Probable Week:	Week 10 (25-08-2025 - 31-08-2025)	CO Mapping:	CO3
Practical Aim:	Detect network motifs like triangles and stars, analyze frequency.		
Practical Tasks:	Find motifs, compare with random graph.		
Practical Pedagogy:	Problem-Based/Case Study Learning		
Evaluation Methods:	Viva, Lab Performance, File Submission		
Associated Units:	Predictive and Behavioral Network Models, Community and Connectivity Analysis		
Blooms Taxonomy:	Analyze, Evaluate, Create		
Skill Mapping:	Technical Skills		
Skill Objectives:	Detect triangles, stars, analyze frequency and compare with random graphs		
Reference Material:	NPTEL Course: Social Networks by Prof. Tanmoy Chakraborty SNAP Library Documentation: https://snap.stanford.edu NetworkX, igraph Documentation		
Software/Hardware Requirements:	Python, NetworkX		

Practical 8

Faculty Name:	Ankita Amaravat	Lab Hours:	4
Probable Week:	Week 13 (15-09-2025 - 21-09-2025)	CO Mapping:	CO4
Practical Aim:	Load large networks in Gephi. Apply layouts and compare effectiveness visually.		
Practical Tasks:	Try multiple layouts, highlight communities, use filters.		
Practical Pedagogy:	Problem-Based/Case Study Learning		
Evaluation Methods:	Viva, Lab Performance, File Submission		
Associated Units:	Predictive and Behavioral Network Models		
Blooms Taxonomy:	Analyze, Evaluate, Apply		
Skill Mapping:	Technical Skills		
Skill Objectives:	Layout application, styling, visualization		
Reference Material:	NPTEL Course: Social Networks by Prof. Tanmoy Chakraborty SNAP Library Documentation: https://snap.stanford.edu NetworkX, igraph Documentation		
Software/Hardware Requirements:	Gephi		

4. CIE DETAILS

No.	Unit Covered	Date	Marks	Duration (mins)	Evaluation Type	Bloom's Taxonomy	Evaluation Pedagogy	CO/PSO/PEO	Skills
1	-	03/07/2025	15 Marks	45 mins	Course Prerequisites CIE	Analyze, Apply, Create, Evaluate, Understand	Objective-Based Assessment (Quiz/MCQ)	CO1	Technical Skills
2	2	11/08/2025	20 Marks	60 mins	Lecture CIE	Create, Evaluate	Group/Team Assessment	CO1, PSO2, PEO4	Leadership and Teamwork Skills
3	4, 3	03/10/2025	20 Marks	60 mins	Lecture CIE	Analyze, Apply, Evaluate	Assignment-Based Evaluation (Homework/Take-home assignments)	CO1, CO2, PSO1, PEO4	Professional Skills
		Total	40 Marks	2 hours					
4	-	25/07/2025	20 Marks	60 mins	Practical CIE	Analyze, Apply, Create, Evaluate	Problem-Based Evaluation	CO1, PSO2, PEO3	Technical Skills
5	-	09/09/2025	20 Marks	120 mins	Internal Practical	Analyze, Evaluate	Critical Thinking Assessment	CO1, CO2, PSO1, PSO2, PEO4	Creativity and Design Thinking Skills
		Total	40 Marks	3 hours					
6	1, 2, 3, 4, 5	09/10/2025	30 Marks	90 mins	Mid-term/Internal Exam	Analyze, Create, Evaluate	Short/Descriptive Evaluation	CO1, CO2, CO3, CO4, CO5, PSO1, PEO2, PEO3	Cognitive Skills

Overall Total	125 Marks	7 hours 15 minutes

5. ADDITIONAL DETAILS

Academic Integrity:	Behave in a manner suitable for a pre-final year student preparing for placements and internships. Strictly follow the rules of honesty in assignments, exams, and projects.
Attendance Policy:	Minimum 75% attendance is required as per academic regulations.
CIE Guidelines:	Out of 6 conducted, the best score of 4 will be considered.
Classroom Conduct:	Students are expected to arrive on time for all lectures, labs, and seminars. Minimum 75% attendance is required as per academic regulations. Behave in a manner suitable for a pre-final year student preparing for placements and internships. Engage actively in classroom discussions, case studies, and group activities. Strictly follow the rules of honesty in assignments, exams, and projects.
Communication Channels:	All the course related announcements will be done on google classroom only.

This LPD was downloaded on 11/07/2025 by Ankita Amaravat